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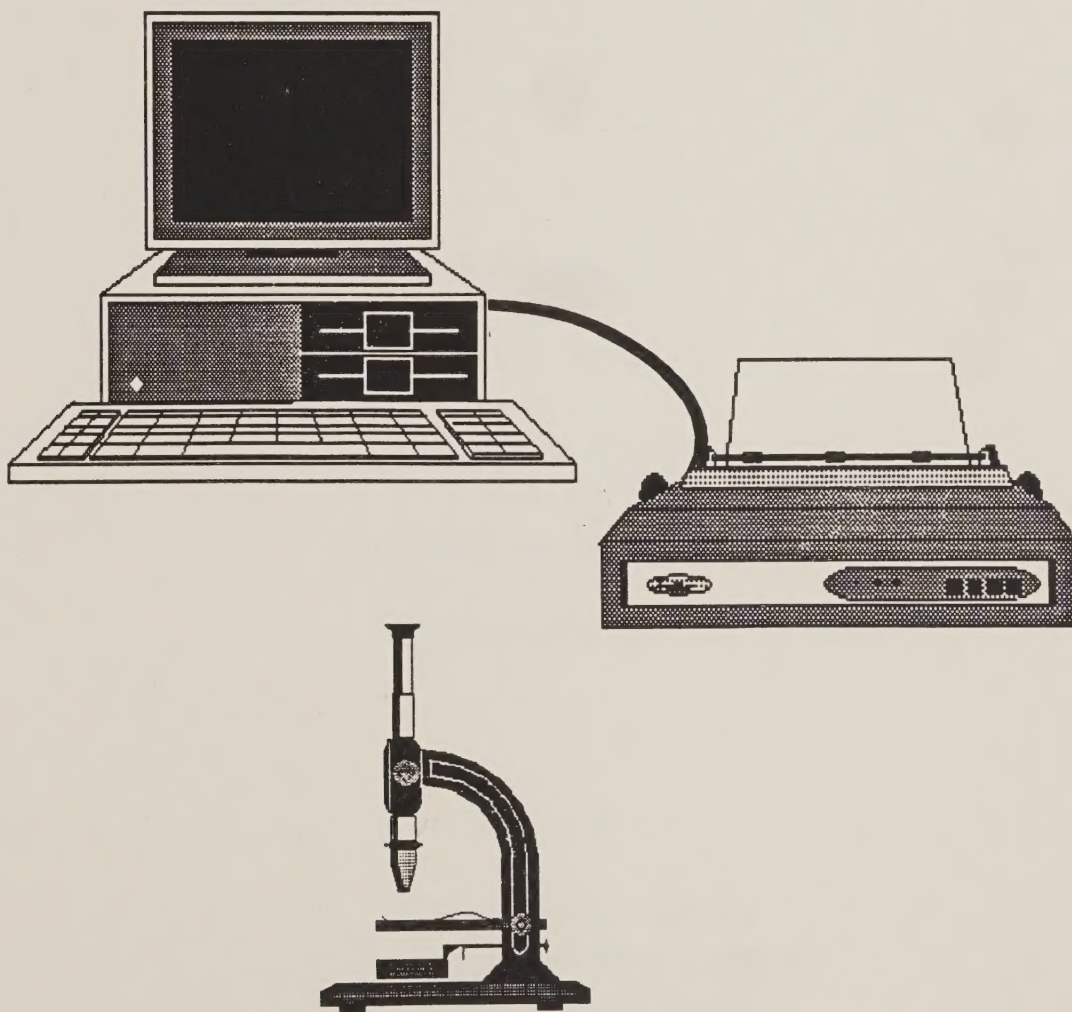
Forest Service

Forest Pest
Management

Davis, CA

ASCAS (Automatic Spot Counting and Sizing) Program Version 4.0

User Documentation



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ASCAS (Automatic Spot Counting
and Sizing) Program
Version 4.0

User Documentation

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INTRODUCTION

Use of paper cards to detect pesticide droplets has been a common practice for several decades. Deposit on cards provides an indication of how much spray reached the target and conversely how much deposited off-target. Spray cards are also used to characterize the atomization from aerial and ground sprayers - that is, how many drops in what drop sizes deposited on samplers or targets. Therefore the cards are all used both qualitatively and quantitatively.

The procedure for spray deposit assessment consists of four steps: (1) collection of spray on deposit cards in the project area; (2) counting and sizing stains or spots on a rectangular section of the card done by either hand counting (using a plastic overlay with a grid and microscope or hand lens with an internal scale) or automatically with an image analyzer; (3) analysis of the spot count data with the ASCAS Program; and (4) evaluation of spray deposit results through comparison of spray deposit versus insect mortality, tree defoliation, and canopy penetration, spray drift, meteorology, etc.

The Automatic Spot Counting and Sizing (ASCAS) program was originally developed by the U.S. Army Dugway Proving Ground (DPG), Utah. ASCAS, using as input the raw data from the image analyzer or hand counting, converts the raw data to values of drop size and mass/volume.

ASCAS has evolved with a rich history of development, refinement and enhancement. The earliest document (Stewart 1966) gives a technical background to the interpretation of data witness cards. The transferring of the ASCAS program to faster computers and image analyzers, as they became available, is summarized by Barry (1976). A complete user manual for the operation of ASCAS on main-frame computers using image analysis from the Quantimet Image Analyzer is given in Young et al. (1977). Latest (and present) development has advanced to the personal computer platform, and a simple spot digitizing plug-in board, camera and interpretation software (Sanderson 1991).

This user manual moves through the various menus and output options available in Version 4.0 of ASCAS. The accompanying diskette contains the program for operation on a personal computer.

ASCAS is initiated with the command

```
ASCAS <cr>
```

followed by a carriage return < cr > or enter keystroke. The program must be in the current subdirectory, or accessed through the DOS PATH statement. ASCAS may also be invoked with two filenames on the command line

```
ASCAS familyname imagefilename.ext < cr >
```

where familyname is the Family name of the data to be examined (a file to be created in the present run, or saved from a previous run), and imagefilename.ext is the name of the Image Analyzer data file (with extension) created by the Card Counting software developed by Sanderson (1991).

ASCAS is configured for operation on CRT color monitors; thus, LCD gray-scale monitors may fail to represent some menus adequately. To overcome this effect the user may initiate ASCAS in a black-and-white mode by including a separate character string ("/g") on the command line to indicate operation on a gray-scale monitor:

```
ASCAS /g <cr>
```

```
ASCAS familyname imagefilename.ext /g <cr>
```

All operations will then commence in black and white only.

ASCAS appends the following extensions to the familyname:

- | | |
|-----|---|
| DAT | The complete data entry file (combining the image analyzer information) |
| DEF | Exportable definition file |
| DRF | Exportable drop size file |
| OUT | Calculated drop size file |
| PRT | Output printer listing file |

ASCAS OPERATION

ASCAS is initiated with the command

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ASCAS < cr >
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ASCAS /g < cr >
```

```
ASCAS familyname imagename.ext /g < cr >
```

All operations will then commence in black and white only.

ASCAS appends the following extensions to the familyname:

DAT	The complete data entry file (combining the image analyzer information)
DEP	Exportable deposition file
DRP	Exportable drop size file
OUT	Calculated drop size file
PRT	Output printer listing file

Only screen dumps of plotted images may be performed inside ASCAS; hence, the DOS GRAPHICS command must be invoked prior to running ASCAS, or higher-level copy techniques (such as PIZZAZ PLUS) must be in place.

ASCAS is now menu-driven. Movement around menus is made by the cursor arrow keys; a carriage return, or enter, selects an option; data entry is completed with a carriage return or enter; and the escape key < esc > exits a menu (program operations may be performed upon menu exit).

The main menu gives:

Information
Files/Output
Data Description
Stain Count Data
Statistics
Graphics
EXIT

Information

Information provides an overview of ASCAS operation, and its historical references.

Files/Output

Files/Output leads to the menu:

FAMILY Name
Image Analyzer Name
Screen Type

which will be entered automatically if file names are present on the command line. ASCAS will NOT operate without a Family name! If input includes data from an image analyzer data file, that name should be entered only when building the original DAT file (if the Image Analyzer

Name is re-entered, changed data may be overwritten). Screen Type offers CGA, EGA and VGA.

Upon < esc > from this menu, ASCAS will attempt to read the entered files. The program status messages that could occur include:

No FAMILY Name Entered	ASCAS must be given a Family name to read or save input data
Reading familyname.DAT	ASCAS is recovering previously saved data in a Family name
Creating familyname.DAT	ASCAS intends to create a new Family name on EXIT from the program (at user discretion)
Invalid FAMILY Name	The given Family name is not DOS correct
Appending imagename.ext	ASCAS is appending the data found in the image analyzer file to data found in the Family name
Maximum Image Analyzer Entries	No more than 400 lines of data may be present in the image analyzer file
Invalid Image Analyzer Name	The given image analyzer name is not DOS correct

Data Description

Data Description leads to the menu:

Test Description
Test Conditions
Stain Size Description
Spread Factor Description
Output Units

Test Description permits the entry of 24 characters of information about the data set. Test Conditions leads to the menu:

**Release Height
Temperature
Relative Humidity
Wind Speed
Wind Direction
Specific Gravity
Card Spacing
Aircraft Location**

Meteorological conditions are presented for reference only; whatever is entered here is NEVER interpreted by ASCAS. Specific Gravity must, however, be a valid number (water is 1.0). Card Spacing must give the nominal distance between cards on the card line -- units should be added after the number and a blank space -- ASCAS defaults to no units (card number) unless it finds an m for meters or f for feet. Aircraft Location positions the aircraft centerline (in feet or meters) relative to the LEFTMOST card (card number one) as viewed from the pilot's position. For example, if the leftmost card is 40 feet to the left of the aircraft, the Aircraft Location entry would be -40 feet . Note that units may be mixed on Card Spacing and Aircraft Location. ASCAS shares the same general units capability as FSCBG.

Stain Size Description permits entry of:

**Smallest Lower Diameter (in microns)
Largest Upper Diameter (in microns)
Number of Stain Sizes**

relevant to the image analyzer data to be entered. If hand count data is to be entered, these entries are not needed (and will in fact be overwritten by the discrete stain sizes entered in a later menu). Size ranges are from lower diameter to upper diameter, with the next stain size lower diameter being the previous stain size upper diameter. No more than 100 stain sizes may be entered into ASCAS.

Spread Factor Description leads to the menu:

**Equation Form
Coefficient A
Coefficient B
Coefficient C**

where the three forms are:

$$(\text{Drop Diameter}) = A + B * (\text{Stain Diameter}) + C * (\text{Stain Diameter})^2$$

$$(\text{Stain Diameter}) = A + B * (\text{Drop Diameter}) + C * (\text{Drop Diameter})^2$$

$$(\text{Drop Diameter}) = A * (\text{Stain Diameter})^B$$

The coefficients A, B and C are consistent with the selected equation form.

Output Units leads to the menu:

Distance Unit

Volume/Mass Numerator Unit

Volume/Mass Denominator Unit

Number/Drop Denominator Unit

The Distance Unit selects the distance scale for ASCAS output. It **does not have to be the same as Card Spacing or Aircraft Location**. Units are in either no units (card number), feet or meters.

The Volume Numerator Unit may be one of: milligrams, grams, kilograms, ounces, pounds, cubic millimeters, cubic centimeters, cubic meters, liters, cubic inches, cubic feet, fluid ounces or gallons. The Volume and Number Denominator Units may be one of: square millimeters, square centimeters, square meters, hectares, square inches, square feet or acres.

When Data Description is modified, ASCAS will open a Save Status reminder to the user to save input data before exiting the program.

Stain Count Data

Stain Count Data is a full-screen editor that permits the user to move around the stain count data with the cursor arrow keys, delete, carriage return or enter, or adding valid characters (numbers). The form of the file is consistent with the Card Counting software. Each card is identified sequentially by 1, 2, 3, etc. as the FIRST NUMBER in each card (if cards are missing, their numbers should be skipped to keep the Card Spacing consistent). After which should follow a stain count for EVERY stain size anticipated by the program. Separation of counts is by blank spaces. Data on any card may be extended to additional lines of entry, but cannot go

beyond 72 columns of information per line. **CAUTION:** ASCAS will truncate data at 72 columns if the user should inadvertently delete when in column one on a line! **SUGGESTION:** the user should not enter hand count data beyond column 64.

The Card Counting software generates an image analyzer file that contains several pieces of information transferred into the Test Conditions. For the most part the image analyzer file contains the appropriate stain count data without need for user intervention.

All hand count data should be entered with this editor. **TWO DIFFERENCES** exist between image analyzer data and hand count data:

1. The first card (which may extend over several lines) **MUST** be card number 0 and contain the stain size data from the Smallest Lower Diameter (in microns) to the Largest Upper Diameter (in microns); ASCAS will count the entries and determine the Number of Stain Sizes.

2. All subsequent cards must include an extra entry of square centimeters of card read (the image analyzer data area is determined from entry lines in imagename.ext).

When Stain Count Data is modified, ASCAS will open a Save Status reminder to the user to save input data before exiting the program.

Statistics

Statistics interprets all of the entered data, first **Extracting Test Conditions** (reading the appropriate Data Description entries); then **Extracting Drop Size Data** (reading the Stain Count Data); and finally **Computing Statistics**. The program status messages that could occur include:

Card Spacing Inconsistent	Card Spacing must be a positive number
Spread Factors Inconsistent	Spread Factor Coefficients cannot all be zero
Diameter Data Inconsistent	Either the Largest Upper Diameter is smaller or equal to the Smallest

Lower Diameter, there are zero Stain Sizes, or there are more than 100 Stain Sizes

Card Order Not Sequential

Card numbers are not in order

Premature End of Stain Data

Stain Count Data was read without recovering all of the data indicated by program pointers

If successful to this point, ASCAS will proceed to compute and display the following statistics:

Test Description and Meteorology as specified by the user

$$\text{Number Mean Diameter} = \frac{\sum n_i d_i}{\sum n_i}$$

$$\text{Volume Mean Diameter} = \left(\frac{\sum n_i d_i^3}{\sum n_i} \right)^{1/3}$$

$$\text{Sauter Mean Diameter} = \frac{\sum n_i d_i^3}{\sum n_i d_i^2}$$

Number Median Diameter = Diameter at which half the number of drops are below and half the number of drops are above this value

Volume Median Diameter = Diameter at which half the volume of drops are below and half the volume of drops are above this value

Swath width for optional overlap using the Coefficient of Variation approach (Teske et al., 1990)

Number Average Deposition with flight lines separated by Swath Width

Volume Average Deposition with flight lines separated by Swath Width

The formulas given above may be found in Lefebvre (1989) with the notation:

n_i = number of Stain Counts

d_i = volume averaged drop diameter, computed from Herdan (1960)

$$d_i = \left(\frac{d_U^4 - d_L^4}{4 (d_U - d_L)} \right)^{1/3}$$

where d_U is the upper diameter in a drop size, and d_L is the lower diameter.

Σ = summation over all drop sizes

Because field data is sometimes erratic, the Average Depositions may not be representative because Swath Width might be computed erroneously.

Graphics

Graphics permits the presentation of results onto the personal computer screen. The variables that may be plotted include:

Volume/Mass Deposition vs. Distance
Number/Drop Deposition vs. Distance
Volume Median Diameter vs. Distance
Number Median Diameter vs. Distance
Volume/Mass Fraction vs. Drop Size
Number/Drop Fraction vs. Drop Size
Volume/Mass Cumulative Fraction vs. Drop Size
Number/Drop Cumulative Fraction vs. Drop Size
Coefficient of Variation vs. Swath Width
Volume/Mass Overlapped Deposition vs. Distance
Number/Drop Overlapped Deposition vs. Distance

In each case the plot may be centered on the screen (the only plot) or placed in one of the four corners (upper left, upper right, lower left, lower right). The minimum and maximum scale values may also be adjusted by the user; however, the scale lengths are smoothed by the program.

EXIT

EXIT permits exiting from ASCAS. EXIT may also be achieved by < esc > at the main menu. The presented options include:

- Print Results**
- Export Deposition Results**
- Export Drop Size Results**
- FSCBG Calculations**
- New FAMILY Name for Save**
- Save Data in FAMILY Name**
- Return to ASCAS**
- EXIT ASCAS**

Print Results leads to a selection menu of print/no print options:

- Data Description Summary**
- Stain Count Summary**
- Drop Distribution Summary**
- Deposition Results**
- Drop Size Results**
- Coefficient of Variation**

Data Description Summary prints the Data Description entries; Stain Count Summary prints the Stain Count Data; Drop Distribution Summary prints the Statistics entries. Deposition Results prints column output of Volume/Mass Deposition, Number/Drop Deposition, Volume Median Diameter and Number Median Diameter as functions of Card Spacing. Drop Size Results prints column output of Volume/Mass Fraction, Number/Drop Fraction, Volume/Mass Cumulative Fraction and Number/Drop Cumulative Fraction as functions of Drop Size. Coefficient of Variation prints column output of COV as a function of Swath Width

Export Deposition Results generates the file familyname.DEP and stores column data (separated by a comma) of Card Spacing, Volume/Mass Deposition, Number/Drop Deposition, Volume Median Diameter and Number Median Diameter. This file may then be read by other graphics/statistical packages such as Lotus 1-2-3 or Harvard Graphics.

Export Drop Size Results generates the file familyname.DRP and stores column data (separated by a comma) of Drop Diameter, Volume/Mass Fraction, Number/Drop Fraction, Volume/Mass Cumulative

Fraction and Number/Drop Cumulative Fraction. This file may then be read by other graphics/statistical packages such as Lotus 1-2-3 or Harvard Graphics.

FSCBG Calculations generates the file familyname.OUT and stores column data (separated by a comma) of Drop Diameter and Volume/Mass Fraction. Before exporting begins, the user is presented with the additional menu:

Minimum Diameter (in microns)
Initial Diameter Increment (in microns)
Diameter Increment Factor

where defaults have been entered for convenience. The first drop increment will begin at the Minimum Diameter and end at the Minimum Diameter plus the Initial Diameter Increment. The Increment Factor will then be applied to the Diameter Increment to generate the next Diameter Increment. This process continues until the Maximum Diameter entered into ASCAS is reached, or sixteen drop sizes are computed. Thus, for example, if the Minimum Diameter is 0 microns, Initial Diameter Increment is 32 microns, and Increment Factor is 1.05 (the default settings), the first four drop sizes (in microns) become:

Minimum Diameter	Diameter Increment	Maximum Diameter	Average Diameter
0.0	32.0	32.0	20.16
32.0	33.6	65.6	50.66
65.6	35.3	100.9	84.48
100.9	37.0	137.9	120.35

Uniform increments are achieved with Increment Factor of 1.0. This file may then be printed and used to enter drop size distribution data directly into FSCBG.

New FAMILY Name for Save permits the user to enter a new familyname.

Save Data in FAMILY Name writes all input data into familyname.DAT.

Return to ASCAS permits the user to return to the program. This is especially useful if the user wishes to save hand count data periodically as it is being entered, and in case < esc > was mistakenly pushed.

EXIT ASCAS really exits the program. **Input data will NOT be saved even if the user has changed it**, unless the Save Data in FAMILY Name has been invoked before exiting ASCAS.

EXAMPLE CASES

Two example cases are included on the program diskette.

HAND.DAT is a typical hand count file, and gives the following statistics:

Number Median Diameter	71.31 microns
Volume Median Diameter	82.58 microns

IMAG.DAT is a typical image analyzer file, and gives the following statistics:

Number Median Diameter	188.28 microns
Volume Median Diameter	358.59 microns

REFERENCES

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- Sanderson, JR. 1991. Card counter operation. New Mexico State University. Las Cruces, NM.
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